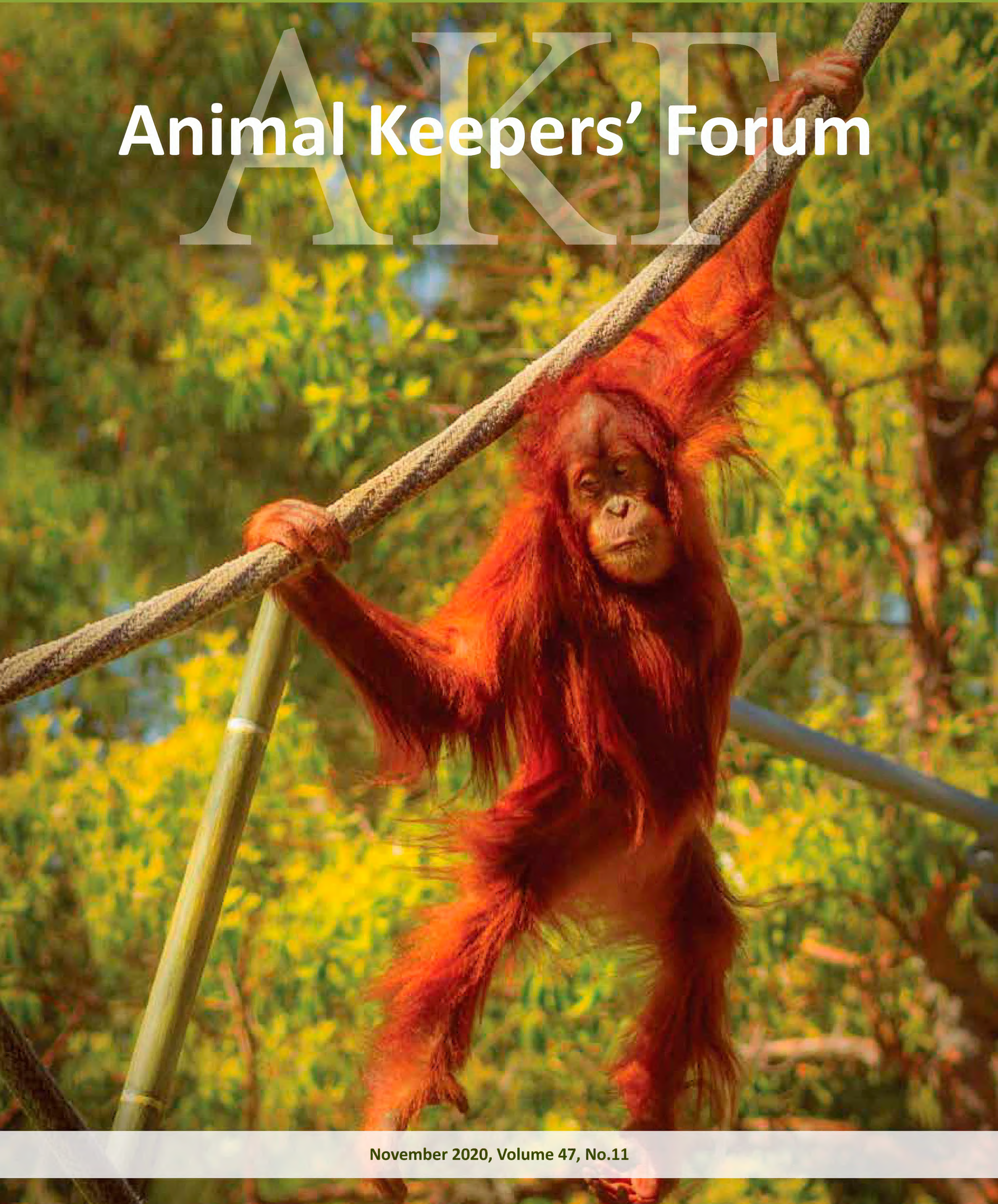
The Journal of the American Association of Zoo Keepers, Inc.

AKF

Animal Keepers' Forum



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American Association of Zoo Keepers, Inc.

The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover photo comes to us from Rafael Sanchez Vidal of Dolphin Adventure in Puerto Vallarta, Mexico and features an orangutan photographed at the San Diego Zoo. Orangutans are the largest arboreal mammals and the most socially solitary of the great apes. All three orangutan species — Bornean, Sumatran and the newly discovered Tapanuli — are critically endangered, primarily due to habitat loss. Orangutan means "person of the forest" in the Indonesian and Malaysian languages. Orangutans have cognitive maps, often returning to the same feeding sites they have visited in the past to forage for fruit, insects and flowers.

To recognize the most iconic victim of the palm oil industry, International Orangutan Day has been set for August 19th, of every year. This event is to help encourage the public to take action in preserving this amazing species.

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month. Dedicated issues may have separate deadline dates and will be noted by the Editor.

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ANIMAL KEEPERS' FORUM

TO CONTACT THE *AKF* EDITOR:
Shane Good, AKF Editor
P.O. Box 535, Valley City, OH 44280
330-483-1104
Shane.Good@aazk.org

AAZK Administrative Office

American Association of Zoo Keepers
8476 E. Speedway Blvd. Suite 204
Tucson, AZ 85710-1728
520-298-9688 (Phone/Fax)

CHIEF EXECUTIVE/FINANCIAL OFFICER:
Ed Hansen | Ed.Hansen@aazk.org

DIRECTOR of PROFESSIONAL DEVELOPMENT and CONFERENCE MANAGEMENT
Bethany Bingham, Bethany.Bingham@aazk.org

ANIMAL KEEPERS' FORUM - EDITOR
Shane Good, Shane.Good@aazk.org
GRAPHIC DESIGNER
Elizabeth Thibodeaux, Elizabeth.Thibodeaux@aazk.org
ENRICHMENT OPTIONS COLUMN COORDINATORS
Stephanie Miner
Beth Stark-Posta, Beth Ament-Briggs
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FROM THE PRESIDENT

> ***Advancing excellence in the animal keeper profession has always been and will continue to be essential to the success of AAZK as a member association.***

Providing important resources and opportunities to our members is at the forefront of AAZK's mission. A number of recent developments within the past several months have allowed those in leadership positions to gain a greater understanding of what our members are looking for from AAZK and many new resources have already been produced in response. Surveys were recently sent out to two important groups: current members and recently-lapsed members. These surveys sought to understand what members sought to get out of their membership and determine why members chose not to renew their membership.

The lapsed-member survey found that a large number of individuals move on from the Association as a result of separation from employment in the profession. However, in light of the financial difficulties many facilities face due to COVID, it is expected that some of these job losses may not have been the individual's choice. In response to this likelihood, as well as the presence of student and associate members working toward entering the field during a time of depressed opportunities, the professional resources available to members were quickly bulked up. Through efforts of the Professional Development Team and AAZK Resource Committee, the AAZK Member Resources section on the Member's page of the website now includes a collection of Professional Resources including examples of resumes, interview questions, cover letters, CV's, and a resources overview document.

Our current member resource survey found a wide variety of different resources that are being sought by the membership. While the breadth of interests was very diverse, the responses generally requested increased accessibility to animal welfare resources, learning opportunities for presentation skills, and a continuation of efforts to provide job resources. Thank you to everyone who took the time to participate in the survey. We received a massive number of responses with about a quarter of the membership taking part. This sort of participation really helps AAZK get a strong idea of where to go for future endeavors. Expect to see an increase in resources related to these topics over the next year both on the Member's page of the AAZK website and the newly-relaunched AAZK Online. AAZK will also be featuring more widespread communication about what resources are already available, when new resources are produced, and where to find the information you are looking for.

Advancing excellence in the animal keeper profession has always been and will continue to be essential to the success of AAZK as a member association. Feedback from our members is an important factor in these efforts, so please contact the Association with any questions or comments.

Cheers,

Paul
Paul.Brandenburger@aazk.org

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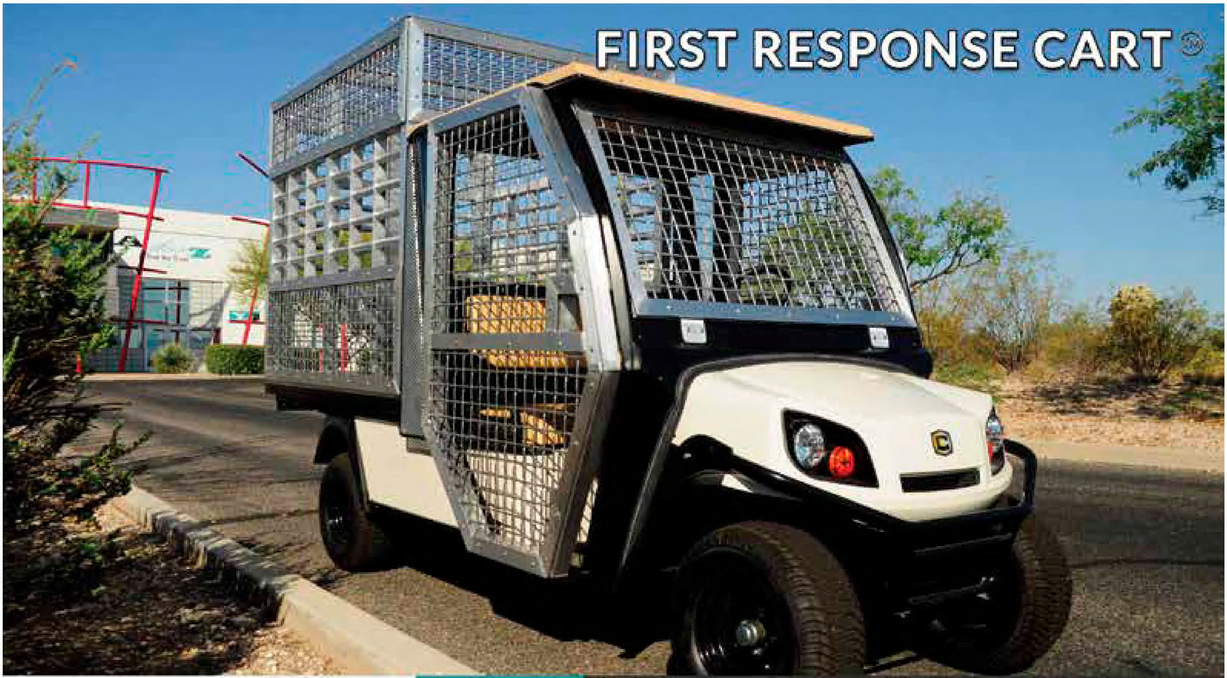

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Manual Restraint of Nubian Ibex and Sudan Barbary Sheep for Regular Procedures via the Use of a Moveable Restraint Wall

Laura Burleson, Lead Zoologist
Dallas Zoo
Dallas, Texas

Introduction

The Dallas Zoo has exhibited Nubian ibex (*Capra nubiana*) since 1987 in the Wilds of Africa mountain exhibit, viewable by zoo visitors via a monorail train. Hand restraint of the herd occurs regularly for a variety of husbandry purposes, including weight collection, body examinations, blood collections, and most frequently, hoof trims. A bachelor group of male Sudan Barbary sheep (*Ammotragus lervia blainei*) was acquired by the Dallas Zoo in 2015, and was housed in the same barn as the Nubian ibex. Hand restraint is used with the Barbary sheep for the same husbandry purposes, although less frequently.

In the past, the ibex have been manually restrained by zoologists entering the stall and attempting to catch the individual animal's horns while it was freely running and jumping around them. Once an animal was held by the horns, additional zoologists could catch the body of the animal to manually restrain it. As could be expected, this method had a far greater likelihood of resulting in injuries to the zoologists involved, as well as being much more stressful for the animal. In the last few years, a new method of manual restraint was developed with a focus on zoologist and animal safety. This involved the use of a Moveable Restraint Wall (MRW), which creates a barrier between zoologists and animals during the restraint process. When the Barbary sheep were acquired, this restraint methodology was crucial for staff and animal safety, due largely to the physical size of the Barbary sheep, which weigh in at roughly 115kg, much larger than the Nubian ibex (60–70kg males, 25–30kg females). The benefits of using a MRW for species requiring frequent restraints are clear when you take into account zoologist safety, animal safety, and minimizing the stress level of the animal.

Design and Specifications

The MRW (Figs. 1 & 2) used in the Nubian ibex barn at the Dallas Zoo was built specifically for the stall in which it is housed. The main structure is composed of a scaffolding frame with a wooden frame built around it. The plywood pieces composing the wall were then attached to that wooden frame. A counterweight composed of three cinder blocks hung on 2"x4" pieces of treated lumber prevent the wall from falling forward, when pushed (Fig. 3).

The scaffolding frame used in the MRW measures 68" tall, 74" long, and 29" wide. Medium-sized casters and wheels were attached to the bottom of the scaffolding frame for ease of movement. The wall portion is comprised of ¼" plywood, which is 8' tall and 113.5" long. The wooden frame (Fig. 4) was built using 2"x4" lumber attached directly to the scaffolding frame with bolts.

Methodology

The methodology for hand restraint of Nubian ibex and Barbary sheep using an MRW will be based solely on the barn layout portrayed in Fig. 9. The basic design could be altered for various species of hoofstock and different barn layouts to work for other institutions.

Zoologists separate the ibex or Barbary sheep between other (not pictured) stalls until the desired individual is located in Stall A. Zoologists give the animal time to enter stall B on their own. If they do not shift on their own, two zoologists will then enter the stall, with the protection of shields or metal shovels and push the animal into Stall B. A third zoologist will remotely operate Door 1 on automatic operation, securing the animal in Stall B, where it will remain until zoologists are ready for the restraint. Stall B is also covered with mesh, so if the animal makes attempts to jump up on the walls, they are unable to jump out of the stall itself.

The MRW is located in Stall C. There are one to two zoologists stationed outside the Stall B Door. These zoologists are responsible for shifting the animal into Stall C if needed, and then restraining the animal's horns. Per current procedures, two zoologists are required for shifting an adult male into Stall C; however, extra zoologists may be necessary to shift animals more prone to pinging off the walls. The second

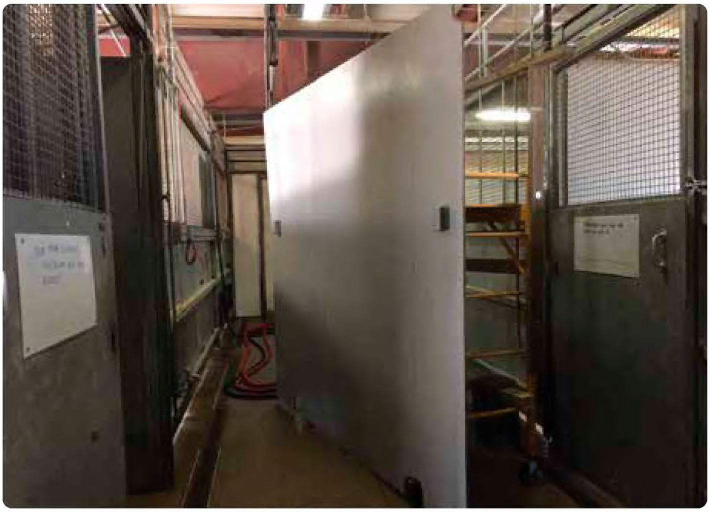


Fig. 1: Front view of Moveable Restraint Wall. Photo by Laura Burleson.

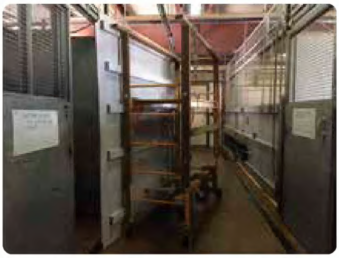


Fig. 2: Back view of Moveable Restraint Wall. Photo by Laura Burleson.

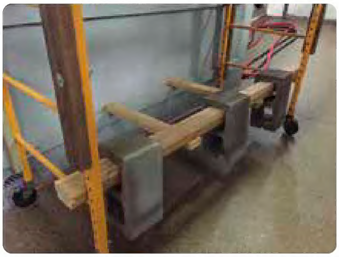


Fig. 3: Cinder block counter-weights. Photo by Laura Burleson.

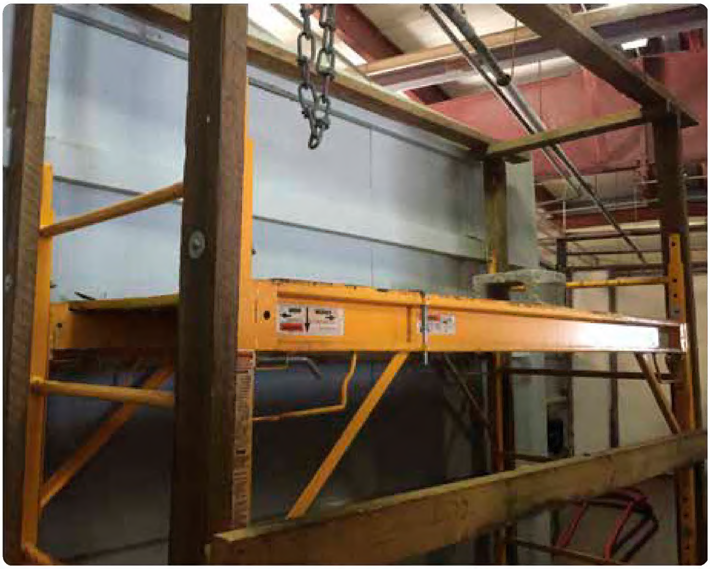


Fig. 4: Wooden frame to which the wall piece attaches. Photo by Laura Burleson.

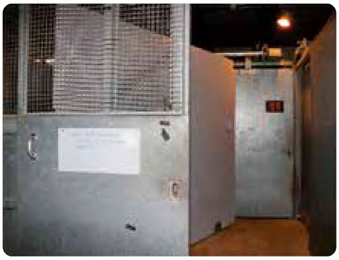


Fig. 5: Overview of Moveable Restraint Wall in restraint stall. Photo by Cathy Burkey.

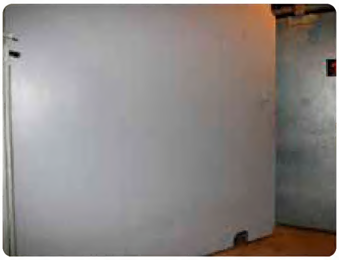


Fig. 6: Close-up of Moveable Restraint Wall in restraint stall. Photo by Cathy Burkey.

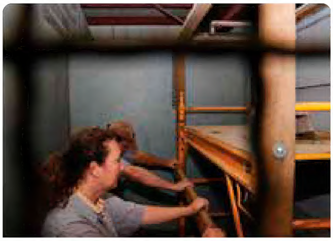


Fig. 7: Staff in position to push MRW. Photo by Cathy Burkey.

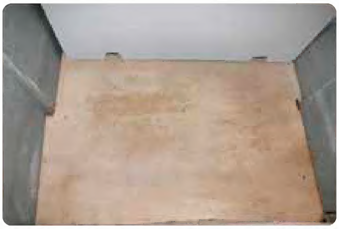


Fig. 8: Empty restraint stall with MRW in position for restraint. Photo by Cathy Burkey.

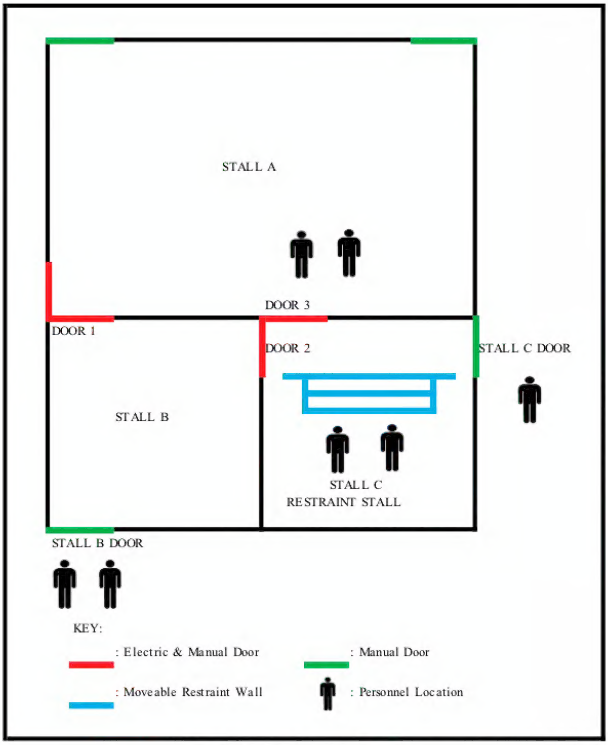


Fig. 9: Animal restraint stall layout.

The methodology for hand restraint of Nubian ibex and Barbary sheep using an MRW will be based solely on the barn layout portrayed in Fig. 9 above.

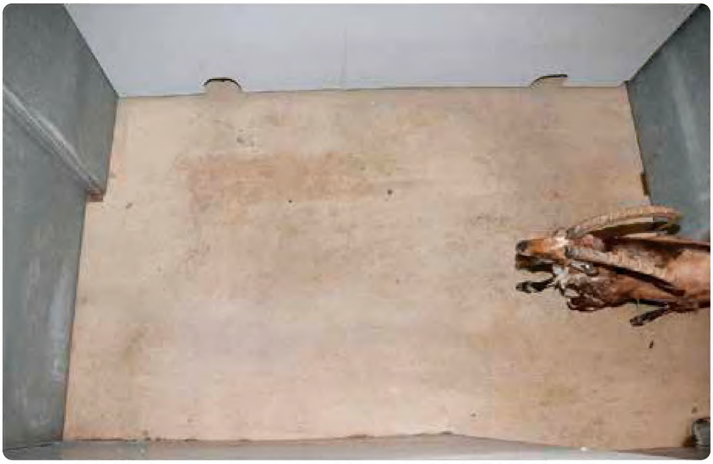


Fig. 10: Male Nubian ibex entering restraint stall via Door 2. Photo by Cathy Burkey.

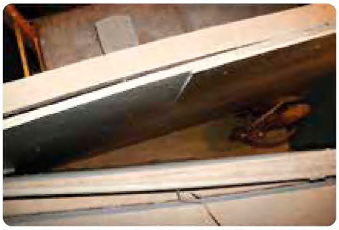


Fig. 11: Ibex being restrained down by MRW. Photo by Cathy Burkey.

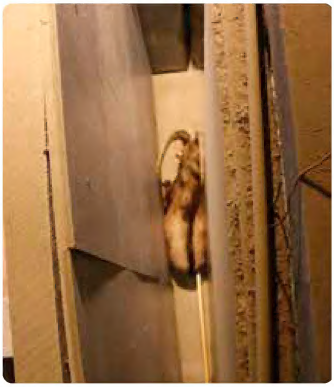


Fig. 12: Staff encouraging ibex forward from Stall C Door using a stick. Photo by Cathy Burkey.

zoologist can also be responsible for applying the eye cover once the animal is in hand. Two zoologists are stationed in Stall A at Door 3. These zoologists are responsible for restraining the animal's flanks and applying the eye cover. There are always two zoologists behind the moveable wall, who are responsible for pushing the wall and restraining the animal between the MRW and the stall wall (Fig. 7). One zoologist remains outside the Stall C Door to operate Door 2 on automatic operation, and to direct zoologists behind the moveable wall when squeezing the animal.

Once staff are in place, Door 2 is opened. The animal is given 1-2 minutes to go into Stall C on its own; if it does not, it can be pushed into the stall by zoologists with a shield. Once the animal is in Stall C, Door 2 is closed behind them (Fig. 10). At this point, the two zoologists behind the moveable wall can begin moving the wall forward under the direction of the zoologist outside of Stall C (Fig. 11). The preferred position of the animal is to have its face at Door 2, with horns squeezed between the MRW and

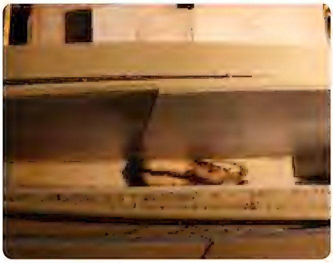


Fig. 13: Ibex in proper restraint position, ready for staff to enter stall for manual restraint. Photo by Cathy Burkey.

the stall wall. If the animal pushes itself back to the Stall C door, the zoologist outside that door can gently prod the animal in the rear with a stick to move it forward (Fig. 12). If the animal has its rear at Door 2, but is facing the wrong way, the zoologists behind Doors 2 or 3 can crack their doors and touch the animal to turn it around.

Once the animal is positioned correctly (Fig. 13), one zoologist will open Door 2, grab hold of the base of the animal's horns, and hold steady. Once they have the horns, the zoologist will verbally confirm. One zoologist will then open Door 3 and restrain the animal's flanks. The flanks should be held tightly and the animal should be held against you to minimize the animal's ability to kick out. Once both zoologists feel secure in their restraint, they will verbally confirm. If needed, extra zoologists can restrain the legs or around the animal's chest to help hold the animal more securely. Another zoologist will then apply the eye cover (Fig. 14). The wall will be pulled back and the animal can be taken out of Stall C to the procedure location in the barn's hallway (Fig. 15). The zoologist holding the animal's horns should be sure to keep the head level above that of the animal's rumen to prevent regurgitation and possible aspiration.

The following procedures are detailed for Nubian ibex hoof trims. Many other procedures can be done while holding the animal up in the air, but ibex hoof trims are almost always performed with the animal restrained on the ground on its side. Once the animal is at the procedure location in the barn's hallway, it is laid on its right side with the legs stretched out. One zoologist continues to hold the horns, two more hold the legs (being careful not to damage the tendons), and one or two put pressure on the hips and shoulders, being careful not to put pressure on the rumen (Figs. 16 &17). The ibex's head must be held up above the level of the rumen due to aspiration concerns.

> *At the Dallas Zoo, only zoologists approved by the area supervisor and veterinary staff may trim hooves.*

At the Dallas Zoo, only zoologists approved by the area supervisor and veterinary staff may trim hooves. Individual animals with severe hoof conformation problems must have a veterinarian present during the trim, but many routine trims are done without veterinary staff present.

Before release, the animal is weighed. The animal is re-flanked by the zoologist who was putting pressure on the animal's hips during the procedure. This zoologist will coordinate standing up with the zoologist holding the animal's horns. Pressure is not relaxed on the hips, shoulders, or legs until the head and flank zoologists are ready to lift the animal up, as this may cause the ibex to struggle.

During the procedure, one zoologist prepares all of the doors for the animal's release. Door 2 is put back on automatic operation and closed, and Door 3 is closed. Door 1 should be open and the door to Stall B should be open and ready for staff to carry the animal into it.

Any husbandry or medical procedures being done with the Barbary sheep are

14: Staff exhibiting proper restraint of ibex: applying eye cover, holding horns with nose pointed down and head level above rumen level, holding flanks, and standing nearby in case extra restraint is needed. Photo by Cathy Burkey.

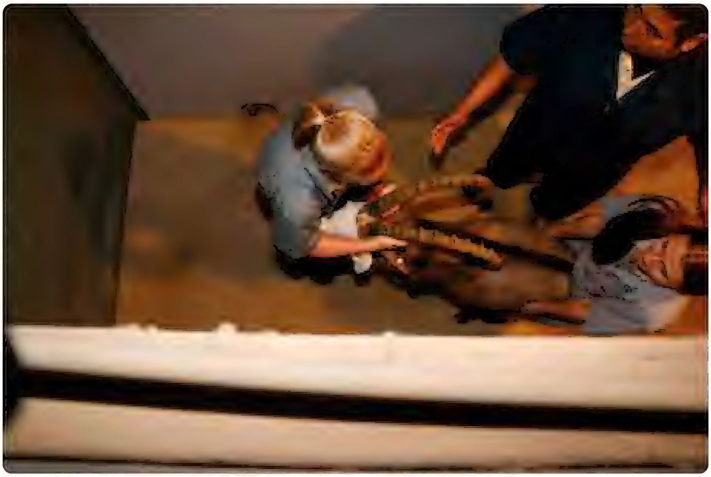
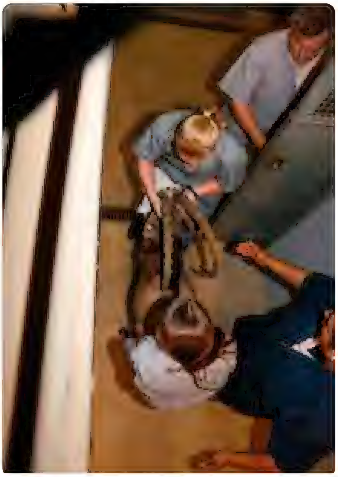


Fig. 15: Staff exiting restraint Stall C with ibex for procedure. Photo by Cathy Burkey.



done with the animal restrained off the ground. During these restraints, zoologists have found that the Barbary sheep tend to hold their rear legs out straight back when held in the air, and they have been able to put the legs around the zoologist's hips to assist with supporting the weight of the animal; then a second zoologist can help restrain the legs behind the other zoologist. Due to their size, two zoologists are typically needed for holding the head up by the horns, one or two zoologists are needed to hold up the animal at the chest, and two or three zoologists are needed to hold up the rear of the animal. Extra zoologists are present to switch out with fatigued staff during the restraint. Smaller-sized animals are able to be carried to a scale for weight collection, but those too heavy to move are voluntarily weighed at other times using operant conditioning. Hoof trims, oral and body examinations, and other procedures can be done while the animal is being held.

Once the trim and/or other medical procedures are completed, the ibex or Barbary sheep is ready to be released. The animal is carried through Stall B and released back into Stall A via Door 1. A zoologist is stationed at the switch for Door 1 to close the door on automatic operation after the animal's release. Releasers must communicate and release toward the center of the stall at the same time, while remembering to remove the eye cover. They should stand with the animal past the doorway, but with zoologists still in the stall for their protection. After the animal is released, Door 1 will be closed. The animal can then be given yard access and/or reunited with its herd. The doors will then be closed behind the individual if additional animals need to be separated off for restraint. Procedures are then repeated for any other individuals requiring manual restraint.

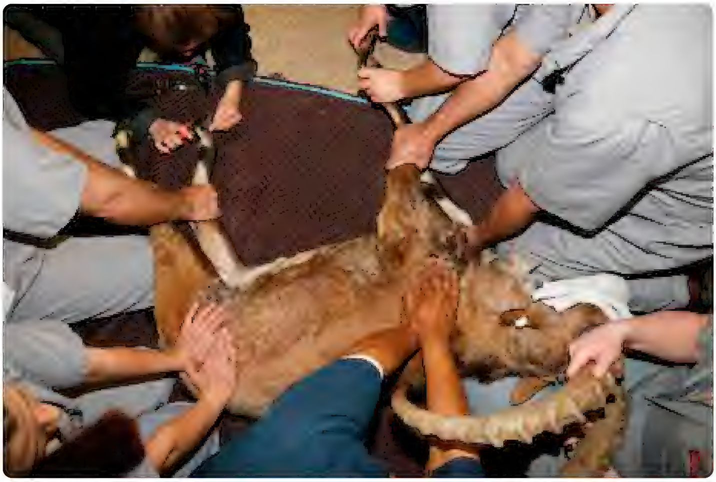


Fig. 16: Staff restraining ibex for hoof trim. Animal is lying on its right side to prevent pressure on the rumen. One staff member is holding the horns, keeping the nose pointed down and head level above rumen level, two personnel are restraining the legs, and two personnel are restraining the hips and shoulders. Two staff members are performing the hoof trim. Photo by Cathy Burkey.

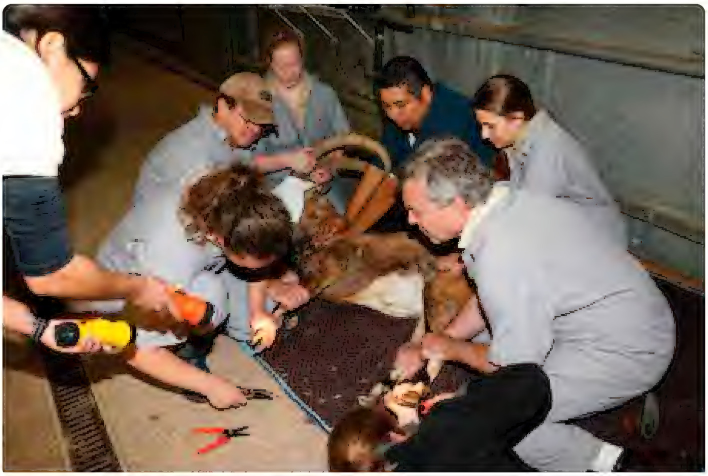
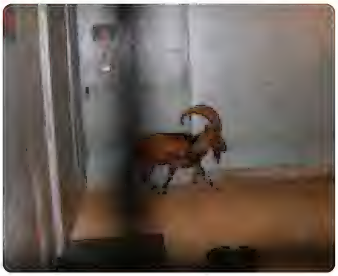


Fig. 17: Staff performing hoof trim on ibex. Photo by Cathy Burkey.

Conclusions

While various methods of manual restraint of small to medium-sized hoofstock are still practiced commonly in zoological facilities, the benefits of using a restraint device such as a Moveable Restraint Wall are quite clear. At the Dallas Zoo, this method of restraint has been used for several years, and personnel and animal injuries have decreased dramatically. With the variety of procedures which can be carried out under manual restraint, the benefits for the individual animal as far as minimizing stress levels are significant as the animal is generally restrained much more quickly and efficiently. This methodology for Nubian ibex and Barbary sheep manual restraint could quite easily be translated for different institutions' housing situations and species of concern, and could have a positive impact on the health and safety of their animals and personnel.

Fig. 18: Ibex being released by personnel via Door 9. Photo by Cathy Burkey.



PUT YOUR HEART INTO IT: Development of Cameron Park Zoo's Ape Cardio Health Workshop

Emily Ellison, Primate Keeper – Cameron Park Zoo
Laura Klutts, former Primate Keeper – Cameron Park Zoo, currently Gorilla Keeper – Cleveland Metroparks Zoo

OVERVIEW

Cardiac disease is a major threat to great apes in managed care. To be proactive and preventative, Cameron Park Zoo trains their orangutans several different non-anesthetized behaviors including blood draw, blood pressure, echocardiograms and electrocardiography (EKG) which can be used as diagnostic tools by the veterinary staff in the event one of our orangutans develops heart issues. Cameron Park Zoo works closely with the Great Ape Heart Project based at Zoo Atlanta. The Great Ape Heart Project is a resource that compiles information pertaining to cardiac disease and acts as an advisory group to assist zoos. Their main goal is to reduce cardiovascular disease mortality by providing feedback on cardiac cases, training advice, disseminating information and coordinating research projects.

In 2015, Cameron Park Zoo hosted an Orangutan Cardio Health Workshop to assist zookeepers and their facilities with training their orangutans for cardiac disease monitoring behaviors. In later years the workshop evolved and expanded to include all four great ape species. By partnering with the Great Ape Heart Project, even more facilities that house various species of apes have had the opportunity to gain information on how cardiac training can be used as a diagnostic tool.

CARDIO PROGRAM BACKGROUND

Cameron Park Zoo's cardio program started in 2013 with the training and completion of voluntary blood draw and then evolved to encompass voluntary echocardiography and male arm blood pressure with the tough cuff in 2014. The program continued with the addition of the development of a female-sized tough cuff and training of obtaining arm blood pressure readings in 2015 and then finger blood pressure training and collection was added a year later in 2016. The most recent addition to the program occurred in 2018 with the introduction of voluntary electrocardiography (EKG).

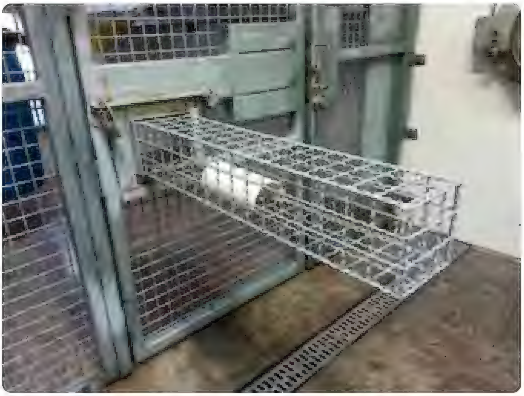
CARDIO PROGRAM ASPECTS

BLOOD DRAW

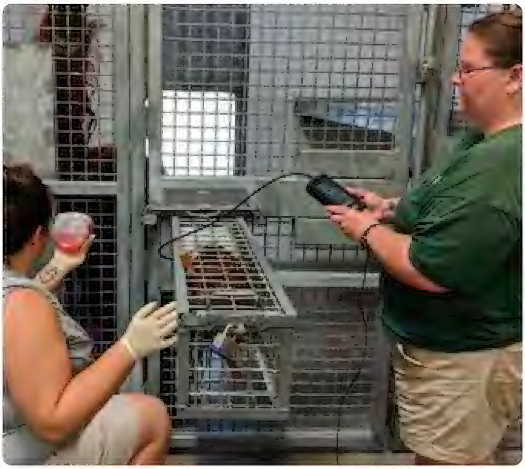
Many facilities commonly train their apes for voluntary blood collection in various ways. The two most utilized sleeve types are either PVC or all mesh. At Cameron Park Zoo it was decided to use an all mesh sleeve method because of increased visibility for the apes, flexibility in vein access, possibility to add multiple variations of sleeve modifications and additional safety elements (See Picture 1). With the use of the mesh sleeve and training method, blood draw was successfully established within five months, resulting in a full blood collection.

BLOOD PRESSURE

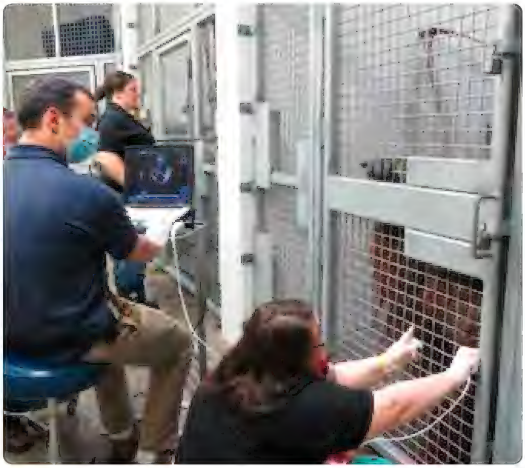
Zoo Atlanta, in collaboration with Georgia Tech, created the tough cuff that was originally intended to train voluntary blood pressure to obtain readings on the arms of male gorillas. They



Picture 1 - Blood draw sleeve with modification



Picture 2 - Tough Cuff blood pressure.



Picture 3 - Voluntary non-anesthetized echo.

then adapted this same tough cuff and training methods for adult male orangutans. Cameron Park Zoo staff learned this method and brought it home to Waco where both of the adult males housed at the zoo were successfully trained in obtaining arm blood pressure readings (See Picture 2).

Cameron Park Zoo wanted to be able to do this same training with their female orangutans, or smaller apes in general. Working with Alpha Technology, a local hydraulic company, a customizable tough cuff was created. This was beneficial for the fact that it is made from the exact material as the original tough cuff for possible future comparisons but can be tailored to fit into any sleeve or for any ape arm size. Because of this tough cuff, both of the females housed at Cameron Park Zoo have been successful in training and obtaining voluntary arm blood pressure readings. Now, Alpha Technology has also been able to create an insert out of the exact same material to offer the option of accommodating multiple sized ape arms with just one main outer tough cuff.

The Great Ape Heart Project's grant-funded Bonobo Blood Pressure study utilizes the PetMAP machine to obtain finger blood pressure readings in apes. Though this was focused on bonobos primarily, this method started to be used in other ape species. Since all of Cameron Park Zoo's adult orangutans were trained with the tough cuff arm method, it was decided to move forward and train finger blood pressure collection with the PetMAP as well.

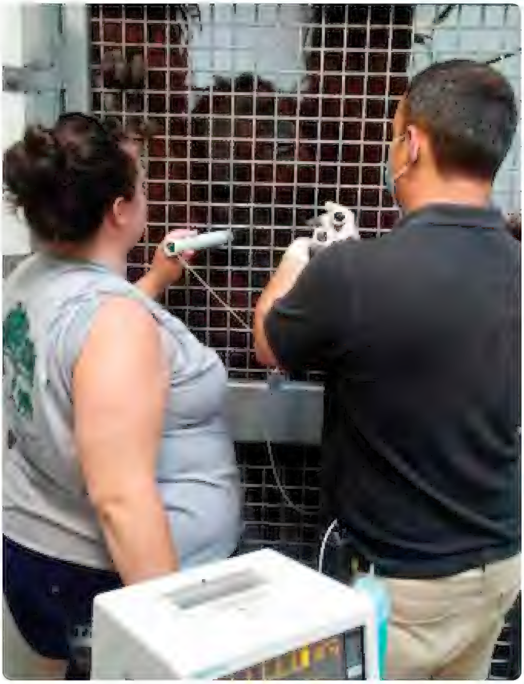
ECHOCARDIOGRAPHY

Ultrasounds are a great tool for getting images of the heart. This is commonly done during anesthetized exams; however, the use of the immobilization drugs can affect those images. Therefore, the training of voluntary non-anesthetized echocardiograms is extremely beneficial for monitoring the heart without chemical influence. Cameron Park Zoo brought in a specialist from a local hospital that aided staff in performing echocardiograms with all of their orangutans (See Picture 3).

EKG

Zoo Atlanta had trained a male orangutan to participate in voluntary EKG using a three-electrode system. Cameron Park Zoo learned of this method and implemented it initially with their two males and has now expanded to training their adult females as well (See Picture 4).

Picture 4 - EKG



Picture 5 - 2015 working on standardization aspects of BP.

Picture 6 - Formal Presentations.

Picture 7 - In person blood draw in orangutan holding.

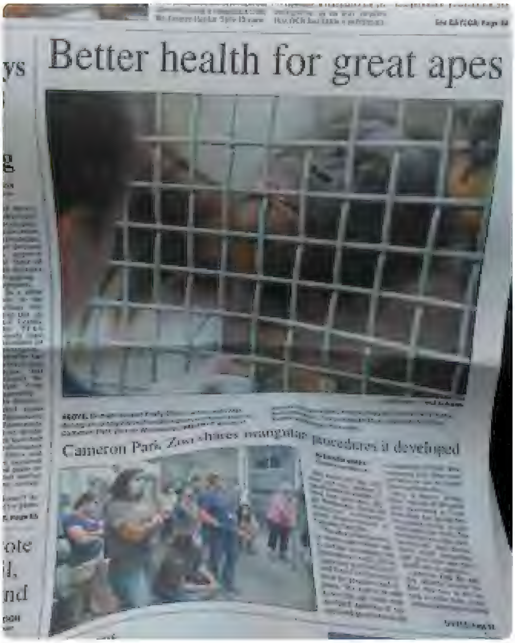
Picture 8 - In person echo demo in orangutan holding.

Picture 9 - Echo demonstration.

Picture 10 - Hands on echo training.

Picture 11 - Media interview with GAHP.

Picture 12 - Front page of local newspaper.



Better health for great apes

Cameron Park Zoo shares orangutan procedures it developed

APE CARDIO HEALTH WORKSHOP

The workshop is held as a one-day overview consisting of various aspects of a cardio program through a collection of formal presentations, hands on training, and in person demonstrations with Cameron Park Zoo's orangutans. Through networking at Orangutan SSP husbandry workshops, staff from Cameron Park Zoo and Zoo Atlanta found the importance and need to work closer together to standardize methodology in obtaining arm blood pressure readings in adult male orangutans with the tough cuff since at the time, they were

Picture 13 - Cardio workshops overall.

Picture 14 - Gorilla blood draw presentation.

the only two facilities consistently obtaining readings. In June 2015, initiation of standardizing between facilities began when Lynn Yakubinis (Lead Primate Keeper at Zoo Atlanta) came to Cameron Park Zoo (See Picture 5). The visit was opened up to anyone interested in coming and this evolved into the first workshop focusing on orangutan cardiac care. The primary goals of the workshop have always been training techniques, trouble shooting, and information sharing with the talks and presentations focusing on blood draw, blood pressure, echocardiograms, EKG and the Great Ape Heart Project (See Pictures 6-10). After the first workshop was held, there was still a large interest and discovered need to continue hosting workshops to aide ape staff, from keepers to veterinarians to directors, in initiating, progressing and advancing their ape cardio programs at their home facilities.

Because there was so much interest, Cameron Park Zoo decided to hold the same workshop on two consecutive days in October 2016 doubling the number of participants able to attend. Overall the Great Ape Heart Project has always played such an important role with ape cardio care, therefore at the conclusion of this workshop a partnership was formed. This enabled the next two workshops, held in April 2018 and April 2019, to include all great ape species since the information learned could be beneficial for any ape program. The Great Ape Heart Project also aided in bringing in speakers representing the other species, since Cameron Park Zoo only houses orangutans. Most recently in October 2020, Cameron Park Zoo hosted a Great Ape Cardiac Health Workshop - COVID-19 edition. Participants received the same involved workshop with the additional necessary safety precautions. Demonstrations were conducted in an outdoor day yard space, with ample social distancing.

The evolution of the Ape Cardio Health Workshop is something Cameron Park Zoo takes great pride in. The zoo has been able to keep the workshop free to all attendees which allows the information to reach the most people possible, ultimately helping as many apes as possible. A secondary positive outcome is having the platform of bringing light to conservation messages when promoting the collaboration between so many facilities to the media (See Pictures 11-12).

PROGRESS

Through the five workshops, Cameron Park Zoo has been able to reach and share information with 161 participants from 58 facilities around the world (these numbers do not include repeat facilities or participants over the years). It has even been a benefit to the zoo's conservation partner, Borneo Orangutan Survival Foundation, where three veterinarians from their facilities were able to attend the 2019 workshop.

Through survey results, it was learned that the workshops have produced about a 50% implementation of some aspect of a cardio program at institutions which house orangutans. It is also known that blood pressure and EKG at various institutions that attended are now being performed with chimpanzees. Results from two separate surveys showed that successfully completing a blood draw in gorillas has proven to be extremely challenging and has only been accomplished at five known institutions throughout Canada and the United States. In hopes to aid facilities with these struggles, a specific presentation and speaker was brought into the 2019 workshop for gorilla blood draw trouble shooting (See Picture 13).

One major outcome from developing the Ape Cardio Workshops at Cameron Park Zoo has been the study of non-anesthetized finger versus arm blood pressure. The zoo is working with a statistician from Baylor University to determine individual trends for each adult orangutan as well as look at trends over time and statistically comparing the two methods. The goal is to obtain five verified left third digit finger blood pressure readings followed by five verified left arm blood pressure readings in the same session utilizing the petMAP machine once per week with each adult orangutan. The veterinarian will verify each reading based on the graphical representation of the reading portrayed by the machine. These verified numbers are taken into consideration when looking at the overall data and figuring out an individual's normal trend ranges.

CONCLUSION

A progressive and proactive orangutan cardiac health program would have never been possible without the direct support from Cameron Park Zoo's veterinarian staff, management, and the Zoological Society board. It has been an exciting time seeing what the potential of growth is of a program over just seven years' time. Cameron Park Zoo is dedicated to continuing the development of the cardio health program with their apes, moving forward with hosting future workshops, as well as continuing with statistics and results from their blood pressure study.

For anyone interested in attending a future workshop, make sure to keep your eyes on the *AKF* calendar, the Cameron Park Zoo's website and other various social media outlets for registration and details as it may come available. For any questions on future workshops feel free to e-mail orangutan@wacotx.gov.

ACKNOWLEDGEMENTS

Cameron Park Zoo Management Staff

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Great Ape Heart Project

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Tiara Kitzler, Primary Orangutan Keeper – Toledo Zoo

Lori Tierney, Veterinarian Technician – Denver Zoo

Orangutan SSP

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Shining a Light on Bats Through Conservation Photography

Alexandra Mason, Education Curator
Riverside Discovery Center
Scottsbluff, Nebraska

Introduction of Microbats and Megabats

There are over 1,400 different species of bats in the world. The smallest species is the bumblebee bat *(Craseonycteris thonglongyai)* also known as Kitti's hog-nosed bat, which is about the size of a dime. The largest is the Malayan Flying fox *(Pteropus vampyrus)* with a six-foot wingspan. Megabats have puppy-like faces, don't echolocate (except for Egyptian fruit bat *(Rousettus aegyptiacus))*, small ears, able to see well and in color, primarily eat fruit and possess no tragus. Bats are important to ecosystems in many different ways. Megabats are responsible for seed dispersal and pollination.

Microbats have larger ears and smaller eyes, primarily feed on insects and have a tragus. Microbats are responsible for insect population control which saves farmers millions of dollars in pesticides and helps prevent the spread of mosquito-borne diseases. The United States and Canada are home to 45 different species of microbats (US Department of Interior, 2017). Bats face many difficulties, including human conflict due to being misunderstood as diseased vermin. In North America, many of the hibernating species are impacted by a disease called white nose

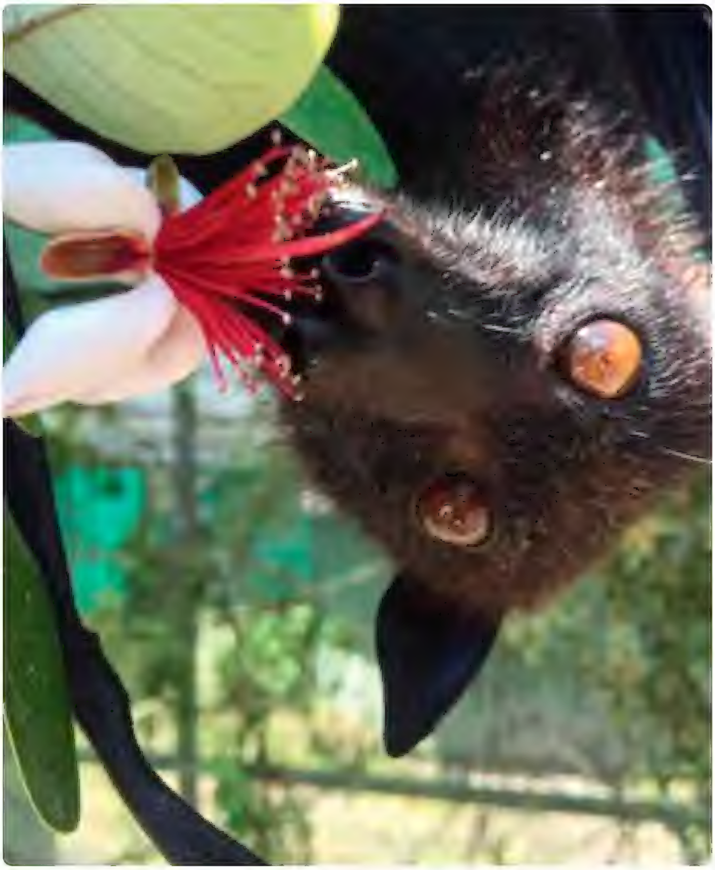

Figure 1. A young Malayan Flying Fox sniffing/eating a flower

Figure 2. Malayan Flying Fox with a mouth full of bananas

Figure 3. Rodrigues Fruit Bat "Grace"

syndrome (WNS). It was first detected in Albany, New York in 2006 (Lorch et al., 2016), and the disease impacts bats by covering their nose and other parts of their bodies with a white fungus. It causes the bats to wake up early during hibernation by covering their nose. They then start to venture out looking for food in the cold winter months, are unable to find food and die of starvation. WNS has killed more than 5.5 million bats in the United States and Canada (Coleman, 2014), and it has been spreading rapidly and first made its appearance in Nebraska inside Cass County in 2017 (Fish and Wildlife Services, 2017).

In 2014, guests at seven AZA facilities were surveyed on their perception of bats before and after bat education opportunities. Forty-seven percent of guests changed their attitude about bats after visiting the exhibit or talking with a staff member (Mason, 2014). Bats, in general, have been the subject of myths and mischaracterizations for centuries; they aren't the most glamorous looking mammals, some are able to host deadly diseases (such as Nipah, Hendra, Ebola, etc.) and tend to get blamed when outbreaks occur. These factors, among others, have given them the negative stigma that they don't deserve. Pathogens from bats and other wildlife to humans isn't the fault of bats or other animals, but the fault of human behavior (Lubee, 2019). Even in 2020, the world-changing pandemic of COVID-19 is being blamed on horseshoe bats in China. It may end up being true that this virus originated in bats, but it is very unlikely that the spread would have occurred if humans were not capturing wildlife for wet markets or wildlife trafficking. Poaching and habitat destruction are human-driven threats to wildlife.

Conservation Photography

The role of conservation photography is to use images to inspire people to change behavior (Mittermeier, 2005) or to save species from extinction.

When powerful images are published or shared, a sense of empathy is felt for the subject. We as zookeepers or educators want the general public to have a desire to learn more after seeing an image. A single photo can inspire change and action as well as give us hope. According to Joshua Sarinana, a neuroscientist at Harvard Medical School, humans are highly visible creatures, there is a strong connection between visual imagery and empathy (Penda Photo Tours, 2020). Photography and Conservation have gone hand and hand for many years and tell a story that any language can understand.

As technology progresses, beautiful photos can be taken with any smartphone and uploaded to social media platforms such as Facebook, Instagram, Twitter, Flickr, Pinterest, etc. and be shared with millions of people around the world.

Before social media, we would see breathtaking high quality photos of wildlife in magazines such as National Geographic or Sierra Club. Those photos may have sparked a collective interest in a specific species and would hopefully inspire action to save them. We saw this with conservation efforts in chimpanzees, gorillas, elephants, whales, and so much more. As technology progresses, beautiful photos can be taken with any smartphone and uploaded to social media platforms such as Facebook, Instagram, Twitter, Flickr, Pinterest, etc. and be shared with millions of people around the world. When people see something new and unique it sparks interest, gets shared and hopefully creates learning and conservation opportunities.

When bats are photographed up close, the captured image can neutralize the "scary" and remind people of their puppy-like aspects. Showcasing uncharismatic species like bats, when they have been associated with negative stigmas, can be a difficult task.

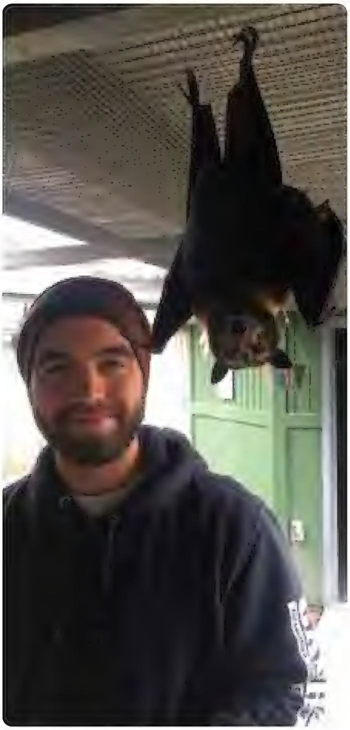

Figure 4. Keeper Anthony Mason with Spectacled Flying Fox "Kuri"

Photographing bats is an important part in communicating that they are a keystone species. Without bats, ecosystems will change drastically for the worse. Conservation photography is a universal language (Ward, 2008) where anyone can understand the issue and encourage citizens to find solutions and advocate for the species.

Photographing Bats

Having a mysterious nature and not being well studied, when compared with other species, has led to numerous misconceptions around bats. When given the opportunity to view bats up close, perceptions of them can change. Lubee Bat Conservancy in Gainesville, Florida organizes a photo day every spring and invites the general public to take close range photos of the ten different species of megabats that they house. What makes this event unique is that guests can go inside the exhibit with the bats to get up close and personal, under the supervision of a staff member. This gives the guests opportunities to get amazing photographs of the bats without any obstacles. Of the ten different species Lubee has, the most photographed are the Malayan Flying Fox (Figure 1 and 2), the Rodrigues Fruit Bat (*Pteropus rodricensis*) (Figure 3), and the only Spectacled Flying Fox (*Pteropus conspicillatus*) (Figure 4) found in North America. During my time as a Lubee staff member, I would hear guests comment that they didn't realize how "cute" or "puppy like" these bats were. After taking the photos, guests wanted to learn about their personalities and the stories of the bats they interacted with. This gave the staff members a perfect opportunity to talk about the issues these bats face in the wild and the conservation efforts taking place to protect them from extinction.

In Austin, Texas millions of Mexican Free Tail Bats (*Tadarida brasiliensis*)(Figure 5) regularly emerge from Bracken Cave (20 million bats) and Congress Bridge (1.5 million bats). This is a hot spot for photographers to get jaw dropping photos of bats emerging at dusk to feed on insects. It is such a sight to see that it brings in $10 million dollars annually to Austin's economy while lowering insect populations.

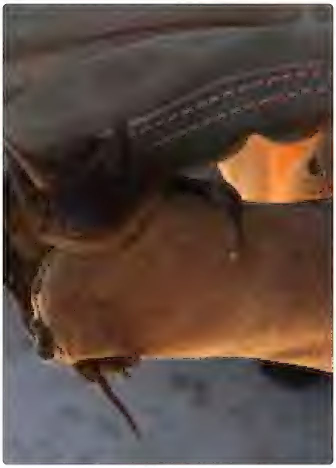

Figure 5. An upclose photo of a Mexican Free Tail Bat

Conclusion

Photography is becoming more and more popular as cell phones become just as good at taking pictures as expensive cameras. Photography also goes hand in hand with social media and everyone likes to share an inspiring or unique photo. You can have a great photo but it needs to be given in the right context or accompanied with a powerful story if you want to ignite change. No one is going to want to save something if they don't appreciate it. With this in mind, it is important to find creative ways to spark an appreciation for these animals. The more we can shine a positive light on uncharismatic species, the better we can advocate for their conservation.

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Clear PVC Puzzle Kit

Micala Teetzen, Australia/South America Mammals Keeper
Sedgwick County Zoo
Wichita, KS

After seeing the poster presentation "Clearly Better PVC Puzzle Feeders" at the 2018 AAZK Conference in Denver, CO, we decided to expand upon the idea of classic PVC puzzle feeders by creating a Build-your-own Puzzle Feeder kit using clear PVC pipe and fittings. It features different lengths of tubes (some with holes, some without), and various tees, fittings and endcaps. See Figure 1.

Benefits of our updated application

Keepers can create puzzles that cater to specific species and individual abilities. For example, for a giant anteater, you could put a cap on one of the longest tubes and make them use their tongue to get some mealworms from the bottom (Figure 2). This is a great method to show zoo guests how long the anteater's tongue is during a keeper chat.

The puzzles can also be made easier to manipulate for certain species (like peccaries or pigs), by making them three-dimensional. Do this by choosing certain fittings or by twisting the elbows so one of the pipes stick up (like those in Figure 3). This gives the animal a pipe that is easy to flip with their snout or grab with their mouth.

After use, they can be disassembled and cleaned and stored for the next use. We store ours in a clear case with a hinged lid purchased from a craft supply store (See Figure 2). They are like tinker toys for zookeepers!

Benefits of using clear PVC

1. The animals can see what treats they are working for.
2. Zoo guests can see what treats are inside too! They create great enrichment demonstrations to use during keeper chats.
3. Keepers can see what is left inside when it is time to clean them. Since the pieces aren't glued together they can be cleaned much better than our typical PVC tubes with caps glued on. (Baby bottle brushes work great to clean inside the pipes.) No more stinky, rotten mouse pinkies dried inside hard-to-clean and difficult-to-see-into feeders!
4. Finally, clear items meet requirements for naturalistic enrichment items thus preventing the need for painting or scorching PVC puzzles.

Additional uses for clear PVC

Make clear capsules by putting caps on the ends of a tube and then filling them with visually interesting items:

- sand and seashells
- colorful beans, rocks or small candies will make a rattle that is visually stimulating in addition to providing auditory enrichment
- fill it with water and glitter to make a snowglobe-like wand (add some clear glue or corn syrup to make the glitter take longer to settle)
- colored water and oil are interesting to watch mix and re-separate

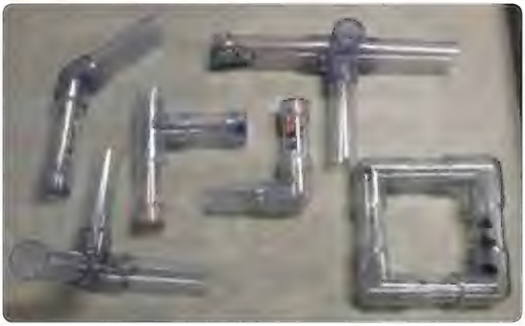


Figure 1. Samples of puzzles that can be made with the kit.

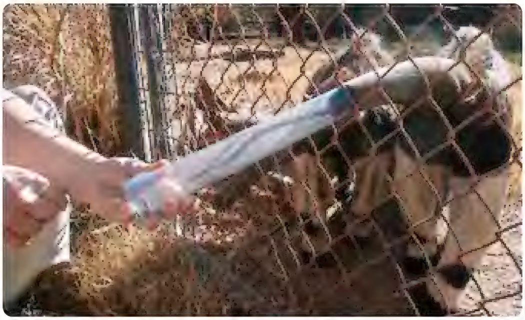


Figure 2. A giant anteater uses its long tongue to retrieve mealworms from the end of a foot-long puzzle.

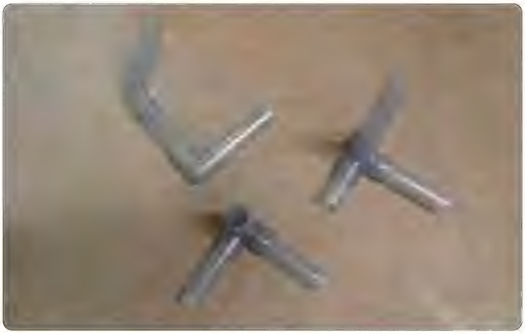


Figure 3. Make puzzles three-dimensional so they are easier for certain animals to manipulate.

Figure 4. The complete PVC kit in a storage case that was purchased at a craft supply store.

Notes: *Since the caps are not glued on, the capsules are NOT watertight. The fit is fairly tight so the water leaks out pretty slowly. If desired, order some extra caps and go ahead and glue caps onto the capsules filled with liquids, so you don't have to worry about leaks.*

Items placed inside the capsules should be non-toxic and not a choking hazard to your animals (i.e. don't use beads, marbles, etc.). These pipes are very shatter-resistant compared to standard PVC (see the Impact Test video on the Duraclear website). Our capsules have been dropped from 4-5 feet and haven't broken yet, but the cap can pop off if it falls just right. Some of these items may be more suitable for use outside the enclosure where animals can look, but not touch.

Also, don't push the endcaps on too hard. They fit quite snugly and can be difficult to remove.

Purchasing clear PVC

Clear PVC is not readily available at your local hardware store. It is typically used in food, beverage and chemical industries as well in laboratories, aquariums and for building furniture. It is generally MUCH more expensive than regular PVC (4-8 times the price), but the two websites listed at the end of this article do have more reasonable prices.

My suggestion is to purchase a large quantity of one size of pipe and fittings, so they are interchangeable. I went with 1 ¼", known as the "Goldilocks" size—not too big, not too small, but just right! I thought it would be the most versatile with the various species in our area. Large enough for peccaries and maned wolves to roll, but small enough for lemurs and coati to manipulate too.

Figure 5 shows quantities and pieces that we ordered. In retrospect, I wish I had ordered more than six endcaps and probably not as many fittings as I did. Our pipes were cut as follows: (8) 4" pieces, (10) 6" pieces, (2) 12" pieces. Figure 6 shows all our pieces.

	PRICE	QTY	TOTAL
1-1/4" DURACLEAR 4-WAY FITTING	$3.48	1	$3.48
1-1/4" DURACLEAR 3-WAY FITTING	$2.88	1	$2.88
1-1/4" DURACLEAR TEE FITTING	$2.88	1	$2.88
1-1/4" DURACLEAR END CAP FITTING	$1.17	6	$7.02
1-1/4" DURACLEAR 45 FITTING	$2.55	2	$5.10
1-1/4" DURACLEAR ELL FITTING	$2.52	8	$20.16
5' 1-1/4" DURACLEAR PIPE SCH 40	$11.55	2	$23.10
	SHIPPING		$15.92
	TOTAL		$80.54

Figure 5. Chart of the contents of our kit and their 2018 prices. All items were purchased from the Duraclear website.

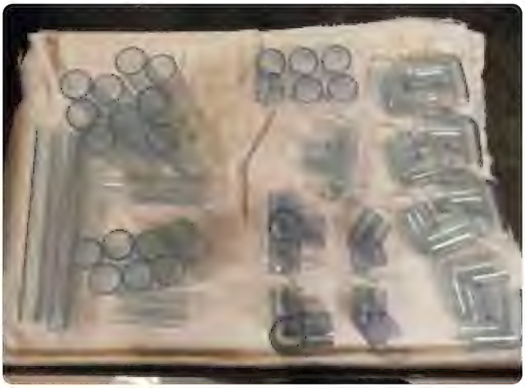


Figure 6. The contents of our kit.

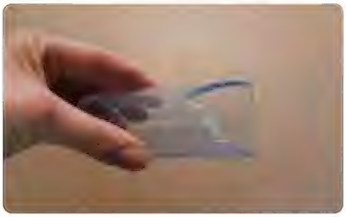


Figure 7. *Jagged edges result from not cutting the pipe slow enough.*

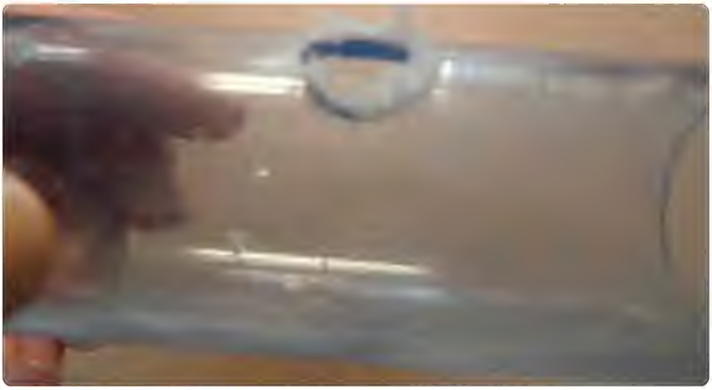


Figure 8. *Burrs are created when drilling holes in clear PVC.*

Cutting and creating your kit

Clear PVC is "softer" than traditional pipe so it is slightly more difficult to cut smoothly. Here is some advice from the Duraclear Plastics website for cutting it:

We have found good results with a 90T blade (finishing), and although some residue gets inside, a quick wipe on the inside pops the "remainder" off clean. The end cut has been extremely smooth. We have also used a 24T wood blade, and this has come off free of any buildup. However, the blade must be dropped slower or it will result in chipping that we do not see at any speed on the finishing blade.

We used a miter saw to make our cuts, and dropped the blade VERY slowly, approximately 10-15 seconds per cut. Make sure to release the trigger switch and allow the blade to come to a complete stop in the down position before lifting the blade. This prevents the teeth from catching on the cut pipe piece and throwing it as a projectile. Cutting too fast or lifting the saw before it comes to a stop can lead to jagged edges (Figure 7). Go slow and don't waste your pipe!

When drilling holes in PVC, start with a small drill bit to make a pilot hole. Then use a bit a few sizes larger and enlarge the hole. Continue using increasingly larger bits until you reach the hole size you desire. Drilling holes in the clear PVC makes some large burrs (Figure 8), but they are fairly easy to remove with the blade of your pocket knife.

The advantage to this kit is that pieces can be added as budget allows and you can integrate scraps leftover from other projects. You can mix in regular white-colored PVC pipes and fittings too, if desired.

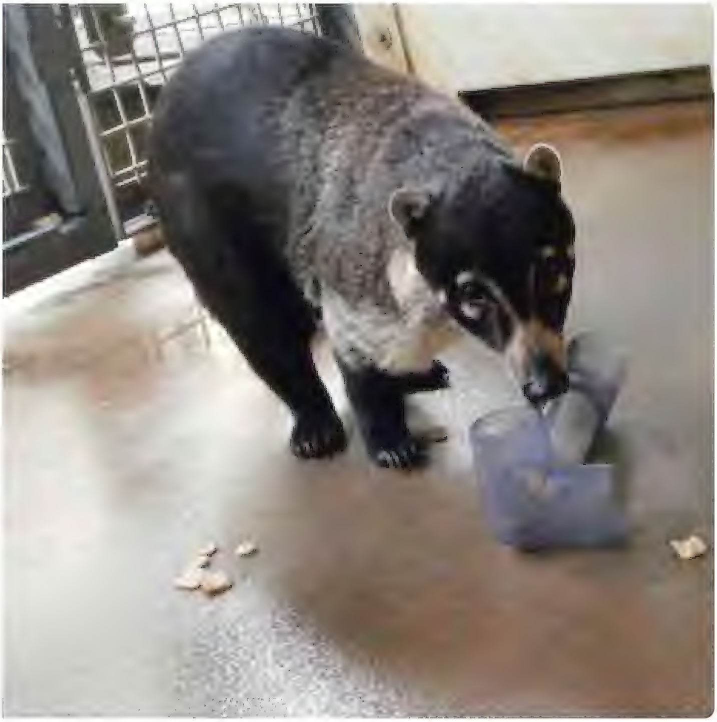


Figure 9. *Coati with treats in puzzle tube*

Figure 10. *Peccary with treats in puzzle tubes*

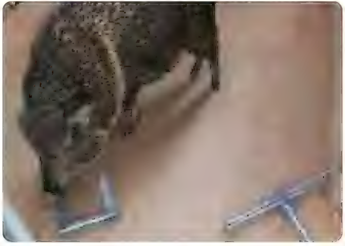
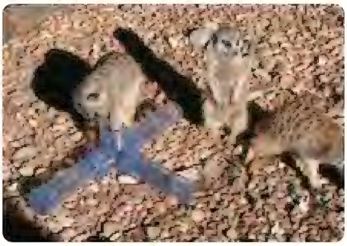


Figure 11. *Meerkats with crickets in puzzle tubes*



PURCHASING INFORMATION

Duraclear Plastics (through C&S Plastics) is the company we ordered all our pieces from. Our pipes and fittings totaled just over $80. Their pieces are about 37% higher than standard PVC. Please note, we ordered ours in 2018 and their prices may have changed for 2019/20.

@ Email: info@duraclearplastics.com

http://duraclearplastics.com/ *Go to the Products tab and choose Duraclear pipe or fittings (it is separate from their colored pipe and fittings)

Formufit is a bit cheaper and has a few different fittings than Duraclear.

@ Email: info@formufit.com

https://formufit.com/collections/1-1-4-in-size-pvc/available-colors_clear-uv

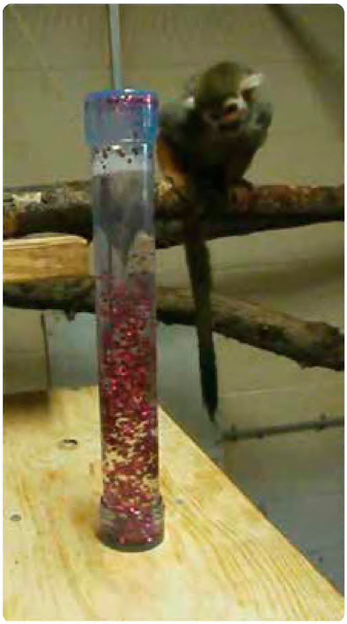


Figure 13. Squirrel monkey with glitter wand

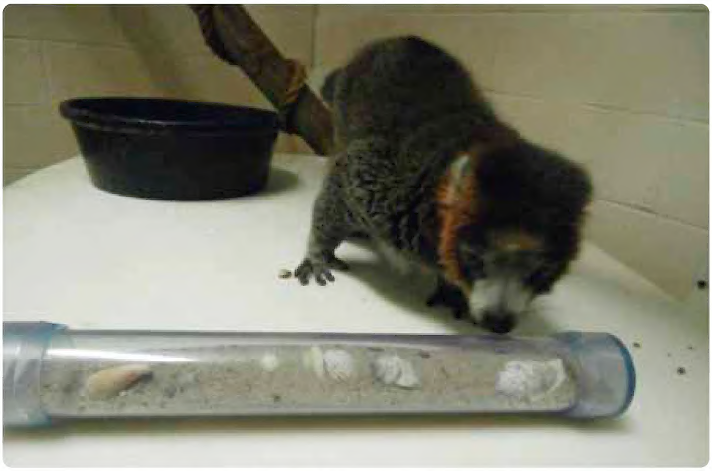


Figure 12. Mongoose lemur checks out the sand and seashells tube.

Figure 14. Squirrel monkeys with small candies in a noisemaker toy that is also visual enrichment

Adding complexity with clear PVC

Complexity can be increased by adding "sleeves" of a larger diameter of PVC to slide back and forth covering treat retrieval holes as they do so. These could be clear PVC (if you ordered some of a larger size) or could be regular white pieces.

The beauty of this kit is that the keeper can make the puzzle as simple or as complex as needed, depending on the animal's skills. Once the animal has solved a simple puzzle, add some more pieces to make it more difficult. With an unlimited number of combinations, the maze can be different every time!

continued on next pg. ⇨

> *The beauty of this kit is that the keeper can make the puzzle as simple or as complex as needed, depending on the animal's skills.*

Special Notes

Safety concerns: some animals may be able to break the pipes leaving sharp edges, some animals may be able to remove caps/fittings that aren't glued together. Animals should be monitored when first receiving any new enrichment device, including this one. Enrichment devices should also be inspected closely prior to each use to ensure there are no new safety concerns.

Species: small or medium primates, small cats, canids, otters, goats, sheep, coatis, raccoons, etc.

Check out this video of Sedgwick County Zoo animals using clear PVC puzzles: https://youtube/RiuPfc1-AJI\

Additional Photos of Sedgwick County Zoo Animals with PVC Puzzles

- White-nosed coati working a clear puzzle feeder (Figure 9).
- Peccaries getting treats from 3-D feeders (Figure 10).
- A complex clear PVC puzzle creates a slow-release cricket feeder for meerkats (Figure 11).
- Mongoose lemur checks out the sand and seashells tube (Figure 12).
- Squirrel monkey with glitter wand (Figure 13).
- Squirrel monkeys with small candies in a noisemaker toy that is also visual enrichment (Figure 14).
- QR code for video of clear PVC tubes in action (Figure 15).
- All photos were taken by the author.

Figure 15. QR code for video of clear PVC tubes in action

ENRICHMENT OPTIONS REVIEW

This article is another great example of the results of animal care staff sharing their ideas with each other! This enrichment opportunity was designed at one institution and then modified and expanded upon at another. After becoming intrigued by the idea, the author returned to her institution and was able to create several different types of enriching opportunities for a variety of species. Not only can this type of device be constructed in many different ways, but it can also be used to meet various behavioral goals by engaging animals in several different types of natural behaviors! In this article, she provides all the details that went into creating her "PVC kit", from advice for purchasing and cutting clear PVC to sharing examples of different levels of difficulty and complexity that have been created for different species. The author also includes a very important note about safety and the possibility that some animals may manipulate these items in a way that can cause a safety concern. Thank you Micala for sharing this project and enriching the lives of so many animals that you care for with a single "device". To everyone reading this, are there any ideas you have seen at other zoos or in other areas of your zoo that you want to try out? Is there something you already have in your area that you could expand upon or modify to give the animals more enriching opportunities? Time to put those thinking caps on!

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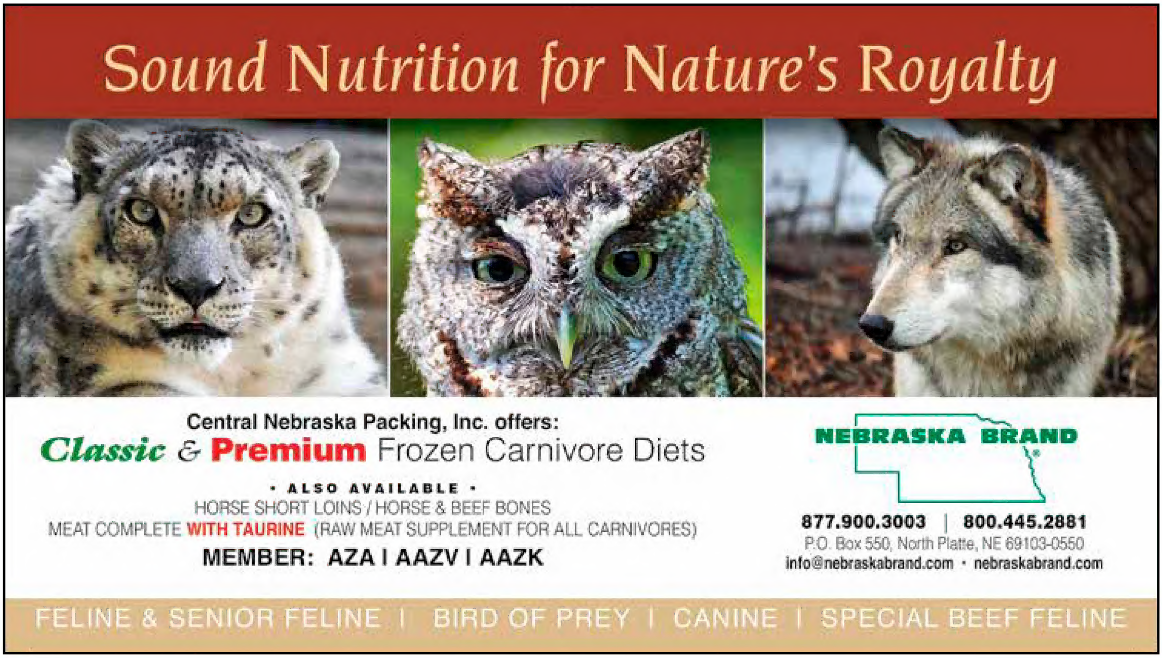
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